

Problem 1

The BJT will remain in forward-active mode as long as the collector-base junction is reverse biased or $V_{BC} < V_{BC(\text{on})}$. A condition for the BJT to remain in forward-active mode is that $V_{CE} > V_{CE,\text{sat}} \approx 0.3\text{V}$

$$V_B = 0 \quad V_{EB} = V_E \quad V_{EB(\text{on})} = 0.7\text{V}$$

$$I_E = \frac{V^+ - V_E}{R_E} = \frac{10 - 0.7}{2\text{k}} = 4.65\text{mA}$$

$$V_B + V_{BC} + I_C R_C - 10\text{V} = 0$$

Forcing the condition that the BJT is in active mode, we can write that $I_C = \alpha I_E \approx I_E$

$$R_C = \frac{10 - V_{BC}}{I_C} = \frac{10 - (V_{CE,\text{sat}} - V_{EB})}{I_C} = \frac{10 - (0.3 - 0.7)}{4.65\text{mA}} = 2.26\text{k}\Omega$$

$$10 = I_E R_E + V_{EB} \quad I_C = \alpha I_E \Rightarrow I_E = I_C / \alpha$$

$$R_E = \frac{2(10 - 0.7)}{I_E} \Rightarrow R_E = \frac{1.9.3}{1\mu} = 9.3\text{k}\Omega$$

$$R_C = \frac{10 - (V_{EC} - V_{EB})}{I_C} = \frac{6}{1\mu} = 6\text{k}\Omega$$

Questions

1. A ; 2. C ; 3. R ; 4. $< V_{BE(\text{on})}, > V_{BC(\text{on})}$